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DEPARTMENT OF COMMERCE

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HAZARDS FROM LOW OR UNDER VOLTAGE



BY

L. C. ILSLEY

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HAZARDS FROM LOW OR UNDER VOLTAGE¹

By L. C. Ilsley²

During the last eight years there has been a noticeable increase in the use of permissible equipment in gassy and dusty coal mines. This trend has undoubtedly been toward greater safety in mining, but in spite of this all is not well "along the front."

In many mines those in charge, either through ignorance or supposed economy, have neglected to install sufficient copper and maintain good bonding on the rails used for return circuits to have a safe working voltage for the permissible equipment which is intended to afford them safety.

Low voltage, when properly analyzed, is not economy but frequently is an expensive oversight. Burned-out armatures, controllers, rheostats, and switches are costly in themselves to repair or replace, but the greatest cost in many instances is the loss of production resulting from idle and broken-down equipment.

From a safety standpoint, excessive low voltage where permissible equipment is necessary is almost criminal negligence. A burn-out of any kind is liable to cause an arc that may burn its way through a casing wall and bring about a hazardous condition if gas or dust in explosive proportions should be present. Again, all wiring, both interior and exterior to the apparatus, is subject to the extra heating consequent upon low voltage. It should be remembered that if the voltage drops the current must increase a corresponding amount in order that the same work may be accomplished; and as the heating effect is as the square of the current, an enormous overheating of the electrical parts and wiring often takes place. This heating effect is especially detrimental to trailing cables used on portable equipment, because under the most favorable conditions the size of cable selected is only barely sufficient to do its work properly at a safe working temperature; therefore, when the extra current load is added because of poor voltage, overheating is sure to result, with consequent deterioration of the insulation. This effect greatly increases the liability of cable failures in service, and in turn adds to the hazards incident to the use of portable equipment of the permissible type involving the use of trailing cables.

1 - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used:

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2 - Electrical Engineer, U. S. Bureau of Mines, Pittsburgh Experiment Station.

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Some manufacturers have tried to protect their equipment from low voltage, especially below a certain point, by installing low-voltage relays which will trip when the voltage falls to a predetermined value. It is understood that some operators have hesitated or refused to install such low-voltage protection because they were aware that the voltage conditions were so poor that the equipment could not operate under the safe limits set. It is difficult to understand how any progressive company that is willing to go to the expense of installing permissible equipment could be so shortsighted in this phase of common sense, safety, and economy.

In certain mines it is understood that where the voltage is normally 250 volts, charts have shown voltage conditions inside the mine ranging from 40 to 80 volts. Such a condition is almost beyond belief and one under which no electrical equipment could possibly operate.

Operators can not expect to have any degree of success in keeping permissible equipment even reasonably safe unless they are willing to face the problem of low voltage honestly and provide sufficient copper along with track maintenance to insure a safe operating voltage.

State inspection departments should check voltage in gassy and dusty mines as they now check the quantity of air coursing the working, as both are intimately connected with safe operation of the mine.